



Revision and validation of a short scale to assess home environment for elementary school children in transnational families in Taiwan

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ABSTRACT

Purpose: To develop and test a brief scale of the home environment of elementary school children in transnational families or vulnerable families.

Design and methods: The scale development process took place in three phases. In the first phase, a 61-item scale was generated by an expert panel based upon related literature and Chinese Home Observation for Measurement of the Environment (C-HOME). In the second phase 15 individual transnational families with elementary school children were interviewed, and items were reduced from 61 to 55 due to understandability or other practical considerations. Phase three's item analysis with 200 such families, reduced items to 41. Factor analysis followed, further reducing items to 27. Finally, the resulting 27-item scale underwent a test-retest with 57 subsample participants.

Results: An iterative process of item and factor analyses identified a seven-dimensional, 27-item Home Environment Assessment Scale (HEAS), which accounted for 52.28% of the total variance. K-R 20 was 0.76. The test-retest reliability for the full sample total score was 0.97.

Conclusions: The results provide evidence supporting the scale consistency, content validity, and construct validity, and offer a useful instrument for health care professionals, especially pediatric nurses, to identify home environment interventions for young children in vulnerable families.

Practice implications: The findings of HEAS-27 can serve to guide pediatric health care professionals in promptly screening, evaluating, and teaching families so that children in a vulnerable population have adequate quality and quantity of support in the home environment.

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Introduction

The home environment provides support for much of a child's growth and development, varying significantly based on factors that contribute to the home context, such as family values, physical environment, and, especially, culture (Jones et al., 2017). Cultural expectations and practices reflecting specific values and other aspects of family ecology impact parenting behavior and thus child development (Bradley & Corwyn, 2005). In Taiwan, families resulting from marriages between people from different countries are often regarded as a vulnerable population because the migrant spouse – typically the female – is typically in a relatively weak position in the marital relationship, while the

male spouse is likely to be from a lower social class and a rural area (Wu, Bradley, & Chiang, 2012). In this study, this population is referred to as “transnational families.” The mothers in these families are ethno-racial minority immigrants who are disadvantaged by challenges that include language barriers, life adjustments, differences with majority values, and conflicts with husbands related to their new cultural environment (Maiter & Stalker, 2011). When these women become mothers, raising children in an unfamiliar mainstream culture, their challenges increase, encompassing extended family dynamics and expectations around parenting, family relationships, and child-rearing.

In Taiwan, the wives in transnational marriages are primarily immigrants from mainland China and Southeast Asia who typically live with their Taiwanese husbands in the lower socio-economic environment of the countryside, where agriculture and fishery are the main industries (Wang, 2010). These women are often expected to, and do, become mothers soon after marrying in order to continue the husband's family line. “New Taiwanese children” (NTC) is defined as children born of

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immigrant women married to Taiwanese husbands. Although the fertility rate in Taiwan declined during the most recent 10 years, with 1,754,095 elementary school students in the 2007 school year and 1,146,679 in the 2017 school year (an average annual decrease of 3.46%), the number of NTC increased from 90,959 in 2007 to 107,407 in 2017, or from 5.19% to 9.37% (Ministry of Education, 2018). With the numbers of NTC on the rise in Taiwan, increased study of their nurture and education has become noteworthy, particularly because of the vulnerabilities associated with these families, including literacy deficiency, lack of support from the mothers' families of origin, disadvantaged financial status, and difficulties of cultural adaptation (Chen, 2013).

Scholars (Belsky, Bell, Bradley, Stallard, & Stewart-Brown, 2007) have shown that young children's home environments play a key role in their development. Widely utilized in studies of children's health and development since the 1970s, the Home Observation for Measurement of the Environment (HOME) Inventory assesses the stimulation and support available to children in the home (Bradley, 1993; Bradley & Caldwell, 1977). HOME has been successfully applied across races, cultures, and countries, with hundreds of studies establishing its psychometric properties (Bangirana et al., 2009; Bradley, Corwyn, & Whiteside-Mansell, 1996; Jones et al., 2017; Williams et al., 2003).

Background

HOME Inventory

The HOME Inventory has been used as a predictor of cognitive development that examines the interaction between home environments and children based upon a variety of factors, including sex, race, socioeconomic status, and household crowding (Bradley & Caldwell, 1984). HOME was first developed and implemented by Bettye Caldwell and her colleagues during the 1960s and has been used worldwide (Caldwell & Bradley, 2003). HOME focuses on the child's responses to the stimulation and support of the home, understanding the child as an active receiver of inputs from objects, events, and interactions in the family environment (Bradley, 1993). HOME exists in four age-based versions: Infant-Toddler (ages 0–3), Early Childhood (ages 3–6), Middle Childhood (ages 6–10), and Early Adolescence (ages 10–15) (Bradley & Corwyn, 2005).

Chinese version of HOME

In Taiwan, Chen and Hsu (1991) introduced a revised Chinese HOME inventory (C-HOME) based on Caldwell and Bradley (1984), with versions for 3–6 year-olds and 6–12 year-olds. C-HOME was used to explore the cognitive development of children exposed in utero to PCB (polychlorinated biphenyl) in relation to home environmental factors (Chen & Hsu, 1997). The C-HOME for 6–12 year-olds has 59 items divided into eight subscales: 1) Emotional and Verbal Responsivity of Parents; 2) Encouragement of Maturity; 3) Emotional Climate of the Home; 4) Growth-Fostering Materials and Experiences; 5) Provision for Active Stimulation; 6) Family Participation in Developmentally Stimulating Experiences; 7) Fathers' Involvement with Child; and 8) Aspects of the Physical Environment (Chen & Hsu, 1991). It also includes 21 observation questions, which public health nurses (PHNs) must assess in-home. C-HOME's reliability was well supported in Taiwan (split-half reliability = 0.89). However, the sample was limited to 25, and 59 items tended to prove too long, requiring a 1.5-hour visit per family (Chen & Hsu, 1991). In C-HOME's use over nearly three decades as a screening and practical tool, a frequent complaint of nurses administering the scale is that it may not be culturally adequate. Professor Chen agreed and encouraged the researchers to adapt the scale for application to the home environment of transnational families.

Thus, the researchers conducted this study in response to the need for a revised scale that is as brief as possible while still assessing and

promoting children's physical and mental health and academic performance. Consideration was given to the fact that immigrant mothers have typically become mothers sooner than their native counterparts, are the main caregivers for their children, and face language barriers. Researchers were also aware of immigrant mothers' frequent distrust of people of other cultures and their reluctance to allow strangers to enter their homes, especially in the years immediately following their relocation to Taiwan. We chose to limit families in this study to those with elementary school age children because the mothers in these families would have been in Taiwan at least six years (according to the age when Taiwanese children are required to begin elementary school), and thus would be more likely to have developed stronger communication abilities as well as a level of trust in others that would allow for access to their homes.

Purpose

The purpose of this study was to (1) update and revise the C-HOME for children aged 6–12 years to accommodate the changes associated with today's culture and (2) determine the reliability and validity of the Home Environment Assessment Scale (HEAS) for elementary school children among transnational families.

Methods

Study design

The study was conducted in three phases: (a) item generation from an expert panel review and discussion, (b) pilot interview with 15 individual immigrant families, and (c) statistical analysis to reduce items and determine the reliability and validity.

Participants

For item generation, a panel discussion among ten experts in the area of children's health, education and counseling, including a pediatrician, two public health nurses, two senior pediatric nurses (one of whom was on a university's pediatric nursing faculty), two elementary school principals, and three elementary school teacher-counselors, formed initial items based on the C-HOME (Chen & Hsu, 1991) and literature review. A pilot test with convenience sampling was applied to recruit 15 transnational families with elementary school children to assess the appropriateness of each item.

For the psychometric test, 200 transnational families with NTC aged 6 to 12 years were recruited through 20 elementary schools. A school-based cluster random sampling method was adopted to collect data. At the first stage, a list of 50 elementary schools having NTC with grades 1–6 was provided by the Educational Department of Chiayi County Government. At the second stage, 20 schools (clusters) were selected randomly. At the third and last stage, we randomly chose one class from each grade in each school. All of the NTC students in the sampled classes were enrolled in our study. After randomly selecting 20 schools, the parents of 200 of 500 available NTC students (40%) whose mothers were from Southeast Asian countries and mainland China agreed to participate. With permission from their principals, teachers were notified and helped to transmit letters requesting home visits. The letters indicated that the purpose of the research was to understand the home environment, and it assured confidentiality of information and availability of summary results. In order to assess the test-retest reliability of HEAS, we further randomly selected half ($n = 100$) of the study subjects who agreed to participate in the study. We expected that the HEAS has an excellent value of test-retest reliability coefficients (i.e., 0.90 and above), which is greater than the median value (0.75) of acceptable test-retest reliability coefficients (0.7–0.8) (Bosakova et al., 2016). With a 0.05 significance level and a statistical power of 0.90, a total of 46 subjects are required. We sent out the invitation to participate in

this test-retest reliability assessment to 100 subjects, allowing for possible non-response, and ultimately received consent from 57 subjects.

Procedures-development process of the HEAS

The HEAS was developed in three phases (Table 1). In the first phase, ten experts in children's health and development generated items. Pediatric nursing faculty, pediatric health care providers, and senior teachers in elementary schools, as detailed above, contributed their knowledge and experience regarding the development of elementary school children. The expert panel's review and discussion resulted in an initial 61-item pool based on a C-HOME (Chen & Hsu, 1991) modification and additional items from a literature review. Nunnally and Bernstein (1994) suggest that item pools contain twice as many items as will be needed for the final form of the scale.

As a scale designed for assessing the home environment of children in transnational families, the items needed to be clear and easily understood. Thus, the objective of the second phase of development was to address the clarity of items for these families. The original 61 items were administered in pilot interviews to 15 unique transnational families with elementary school children to assess the understandability of each item. Participants were encouraged to offer possible alternatives when items were unclear. Based upon these interviews, the expert panel reviewed the items and reduced them to 55, a number that the panel members believed to have adequate content validity for assessing elementary-aged Taiwanese children's home environments. Items were scored on binary outcomes (1 for yes, 0 for no), with no partial credit given. The sum total of all item scores provided the home environment score; higher values indicated a more supportive home environment. The items were administered with primary caregivers of the children, since a primary caregiver is the one with the greatest responsibility for taking care of the child. Primary caregivers are usually the mother or grandparents.

The third phase of development focused on the scale's reliability and construct validity. The Kuder-Richardson 20 formula provided internal consistency testing to evaluate reliability. Descriptive statistics were used to describe the characteristics of the participants and the study variables. Item total correlations were conducted to evaluate items for retention in the scale. The criterion for deleting items was an item total correlation of <0.30 (Bakken, 2018). Exploratory factor analysis was used to evaluate HEAS's construct validity according to the following criteria: (a) factor loading >0.50, (b) an eigenvalue of 1 or more for each dimension, followed by a scree test, and (c) at least two items in each factor (Hair, Ringle, & Sarstedt, 2011; Raubenheimer, 2004). In addition, 57 randomly selected participants were used to retest the scale. Data were analyzed using SPSS for Windows version 22.0 (SPSS Inc., Chicago, IL, USA).

Ethical considerations

We were encouraged by and received written permission from the original developer, Dr. Chen, to update and adapt the C-HOME scale (Chen & Hsu, 1991). After review and approval by the institutional

review board of Chang Gung Medical Foundation, potential participants received information about the study, and written consent was obtained from those who agreed to participate. Assigning code number to each participant ensured confidentiality. Participants were further informed that they could discontinue their participation in the study at any time.

Results

Sample characteristics

The ages of the children in the study ranged from 6 to 12 years, with a mean age of 8.42 (SD = 1.83); they were divided evenly by sex. Participants had a mean BMI of 17.53 (SD = 3.14). Their academic performance scores ranged from 65 to 90, with a mean of 74.98 (SD = 9.02). Of the children's caregivers, 89.5% were parents. Mothers' ages ranged from 21 to 50 years, with a mean of 33.41 (SD = 4.49) years; the majority had a junior high school education or below (72%), and the majority of mothers' country of origin was Vietnam (55.5%). Fathers' ages ranged from 33 to 58 years, with a mean of 44.72 (SD = 5.37) years. Regarding family structure, 46.5% of children lived only with parents. In slightly more than half of cases, three generations lived together as a family (53.5%). About 91.5% of parents were satisfied with their marital status. Sociodemographic characteristics of the participants are summarized in Table 2.

Item and factor analyses

The data of 200 participants were gathered for item analysis. When items with item-total correlations of below 0.30 were excluded, 41 items remained, ranging from 0.32 to 0.78. The 41-item scale was then subjected to principle component analysis with the Varimax method to confirm the construct validity of the scale. Assignment of items to factors was mutually exclusive. Results supported the seven-factor solution with eigenvalues above 1.0. The correlation matrix quality was fair, as measured using Kaiser-Meyer-Olkin (0.67). A significant

Table 2
Demographic information of children and families n = 200.

Variable	n (%)	Mean (SD)	Range
Child's age		8.42 (1.83)	6–12
Child's sex			
Boy	100 (50.0)		
Girl	100 (50.0)		
Child's academic performance		74.98 (9.02)	65–90
< 70	65 (32.5)		
≥ 70	135 (67.5)		
Child's caregivers			
Parents	179 (89.5)		
Other than parents	21 (10.5)		
Mother's age		33.41 (4.49)	21–50
Mother's education			
Junior high school or below	144 (72)		
High school or above	56 (28)		
Mother's home country			
Vietnam	111 (55.5)		
Indonesia	31 (15.5)		
Mainland China	58 (29)		
Father's age		44.72 (5.37)	33–58
Father's education			
Junior high school or below	110 (55)		
High school or above	90 (45)		
Family structure			
Nuclear family	78 (39)		
Single parent family	15 (7.5)		
Kinship family	107 (53.5)		
Parents' marriage satisfaction			
Satisfied	183 (91.5)		
Not satisfied	17 (8.5)		

Table 1
Phases of the scale development.

Phases	Contents
Phase 1	Item generation resulted in 61-item scale.
Phase 2	15 transnational families were interviewed to assess the understandability of each item. An expert panel reformatted and reduced the items to 55.
Phase 3	Statistical analysis: Item analysis (n = 200, 41-item) Factor analysis (n = 200, 27-item) Test-retest of the HEAS-27 version (n = 57, subsample)

Bartlett test of sphericity (Chi-square = 2271.74, $p < .001$) justified the use of factor analysis as a dimension-reducing procedure.

Nine items were subsequently removed because factor loadings fell below the threshold of 0.50 (Hair, Black, Babin, & Anderson, 2009) in all dimensions. The seven-factor solution (see Table 3) accounted for 52.28% of variance, with each factor accounting, respectively, for 9.48%, 8.82%, 7.51%, 7.27%, 6.86%, 6.36%, and 5.98% of the total variance. After factor analysis, items were reformatted and reduced to the final 27-item scale. Table 3 shows factorial rotated loadings.

Internal consistency

The internal consistency reliability for the 27-item scale was good, as indicated by a KR-20 of 0.76. The internal consistency reliability for each subscale was also good or acceptable (Hair et al., 2009): 0.70 for “daily routine” (DR), 0.63 for “active stimulation for growth” (ASG), 0.67 for “positive emotional treatment” (PET), 0.60 for “environmental diversity” (ED), 0.63 for “participation in school activities” (PSA), 0.71 for “parenting involvement” (PI), and 0.61 for “interpersonal and communication stimuli” (ICS) (Table 3). This final scale was termed the Home Environment Assessment Scale (HEAS)-27.

Test-retest analysis

A test-retest comparison of HEAS-27 was conducted in a random sample of 57 subjects who completed the questionnaire twice, with a 10-day interval. The sample ($N = 57$) were school-aged children 6 to 12 years of age, with a mean age of 8.21 ($SD = 1.73$); 50.9% of the 57 participants were girls. Academic performance scores ranged from 65

to 90, with a mean of 76.23 ($SD = 8.93$). 90.2% of caregivers were parents. Mothers' ages ranged from 21 to 45 years, with a mean of 32.86 ($SD = 4.31$) years; the majority had a junior high school education or below (73.7%), and the majority of mothers' country of origin was Vietnam (52.6%). Fathers' ages ranged from 35 to 58 years, with a mean of 45.52 ($SD = 5.77$) years. In nearly half of cases, three generations lived together as a family (49.1%). About 87.7% of parents were satisfied with their marital status. The test-retest reliability of the whole scale was 0.97, ranging from 0.84 to 0.97 on different subscales (Table 4).

Discussion

The original 1991C-HOME (Chen & Hsu, 1991) was revised and its dimensional structure tested on a sample of families in Taiwan. The researchers reduced the questionnaire to 27 items as the HEAS-27, which achieved satisfactory psychometric characteristics in terms of reliability and construct validity. The HEAS-27 encompasses seven distinct home environment components of qualitative and quantitative support for school children: daily routine (DR), active stimulation for growth (ASG), positive emotional treatment (PET), environmental diversity (ED), participation in school activities (PSA), parenting involvement (PI), and interpersonal and communication stimuli (ICS). The acceptable alpha coefficients (0.60–0.71) for the seven subscales indicate seven acceptable factors in the newly developed HEAS-27; internal consistency and reliability suggest its construct validity (Hair et al., 2009). To date, no reliable home observation questionnaires adequate to the current culture in Taiwan have existed because conservatism and a climate of distrust in transnational families makes it difficult for strangers,

Table 3
Items of Home Environment Assessment Scale for elementary school children $n = 200$.

	Factor loading	Corrected item-total correlation	KR-20 if item deleted
Home environment assessment			
I Daily routine-DR			
	KR-20 = 0.76		
1. The child is expected to carry out certain self-care routines (e.g., fold quilt, clean room, clean up after spills, bathe self).	0.78	0.65	0.56
2. The child is expected to keep living and play areas reasonably clean and neat.	0.69	0.55	0.60
3. The child is expected to put his outdoor clothing, dirty clothes, night clothes in a designated place.	0.61	0.33	0.71
4. The child has his/her personal place to keep his/her belongings.	0.50	0.35	0.68
5. The child has his/her personal place to study or do homework.	0.56	0.43	0.66
II Active stimulation for growth-ASG			
	KR-20 = 0.63		
1. The child has access to a musical instrument (piano, drum, ukulele, recorder, etc.).	0.70	0.43	0.55
2. The child has available at least ten appropriate books (other than textbooks) for reading anytime at home.	0.59	0.45	0.54
3. The child has gone to the library with family members at least once a month and has his/her own library card.	0.64	0.38	0.58
4. The child has visited a scientific, historical, or art museum with family members at least once a year.	0.59	0.39	0.58
III Positive emotional treatment-PET			
	KR-20 = 0.67		
1. The child's fears or need for rituals receive empathetic responses (such as allowing night lighting, accompanying the child when confronting new experiences, etc.).	0.51	0.32	0.67
2. The child has been rewarded twice (or more) a week for positive behavior.	0.54	0.38	0.64
3. Caregivers (or families) are happy when others give positive feedback to the child.	0.77	0.55	0.56
4. Caregivers (or families) show positive emotions when they speak to the child.	0.72	0.45	0.61
5. Caregivers (or families) do not complain about the child to others in the child's presence.	0.62	0.45	0.60
IV Environmental diversity-ED			
	KR-20 = 0.60		
1. The child's home is decorated with at least two paintings or pieces of artwork (such as an ancestral portrait or picture calendar).	0.68	0.45	0.45
2. The child's home has a television or computer, and he/she is allowed to use it reasonably.	0.60	0.37	0.56
3. Caregivers (or families) have arranged to take trips out of town with the child in the past year.	0.74	0.41	0.50
V Participation in school activities-PSA			
	KR-20 = 0.63		
1. Caregivers (or families) can name the child's teachers.	0.74	0.52	0.40
2. Caregivers (or families) can name at least three of the child's classmates.	0.76	0.54	0.37
3. Caregivers (or families) participate in the child's school activities at least once a year.	0.58	0.31	0.60
VI Parenting involvement-PI			
	KR-20 = 0.71		
1. The child can see and spend some time with his/her parents at least four days a week.	0.59	0.33	0.71
2. The child eats at least one meal with his/her caregivers a day.	0.86	0.73	0.33
3. The child has lived with his/or her primary family group since he/she was born.	0.81	0.58	0.54
VII, Interpersonal and communication stimuli-ICS			
	KR-20 = 0.61		
1. Caregivers (or families) use well-structured and complete sentences when talking with the child.	0.53	0.43	0.51
2. Caregivers (or families) can lead the child to talk with them about a variety of topics.	0.69	0.43	0.50
3. Caregivers (or families) introduce their family members or friends to the child when they visit.	0.57	0.31	0.61
4. Caregivers (or families) encourage the child to greet visiting family members or friends.	0.72	0.41	0.53

Table 4
Test-retest reliabilities of the Home Environment Assessment Scale (HEAS) (n = 57).

Scale score	Time 1 (Mean ± SD)	Time 2 (Mean ± SD)	Pearson correlation r/p-value
HEAS ^a	21.84 ± 3.38	22.47 ± 3.0	0.97/.000
DR	4.25 ± 1.26	4.39 ± 1.18	0.95/.000
ASG	2.21 ± 1.18	2.25 ± 1.17	0.95/.000
PET	4.49 ± 0.89	4.77 ± 0.46	0.84/.000
ED	2.04 ± 0.98	2.09 ± 0.97	0.97/.000
PSA	2.58 ± 0.68	2.61 ± 0.65	0.96/.000
PI	2.81 ± 0.55	2.84 ± 0.45	0.95/.000
ICS	3.47 ± 0.85	3.53 ± 0.80	0.92/.000

^a DR-daily routine, ASG-active stimulation for growth, PET-positive emotional treatment, ED-environmental diversity, PSA-participation in school activities, PI-parenting involvement, ICS-interpersonal and communication stimuli.

including health care professionals, to gain access to homes. However, the shorter HEAS-27 could allow pediatric health care professionals and PHNs a more efficient home assessment and/or serve as a reference to teach transnational families about the components of a supportive home environment for elementary children.

When interpreting results of the instruments, social values cannot be ignored (Messick, 1980, 1990). Language acquisition and interpersonal communication are important for immigrants' adaptation and support of their children. Three items specifically related to immigrant mothers' communication and cultural development were embedded in two of the seven HEAS components: Factor V (PSA) and Factor VII (ICS). These three items were "Caregivers (or families) participate in the child's school activities at least once a year," "Caregivers (or families) use well-structured and complete sentences when talking with the child," and "Caregivers (or families) can lead the child to talk with them about a variety of topics." Immigrant mothers' communication with others in the community as well as their participation in their children's activities is believed to be crucial in supporting their children's literacy and academic development (Keels & Raver, 2009; Wu & Wu, 2007). Using well-structured and complete sentences was thus included as a home environment scale item on the HEAS. Factor VII included four items that were used to elicit caregivers' (including immigrant mothers') perceptions of "interpersonal and communication stimuli" in order to assess relevant support in the home environment for elementary school children. Furthermore, pediatric health care professionals can easily make evaluations about the home environment using these items.

In this study, we took into consideration the reluctance among transnational families to admit others, including pediatric health care professionals or PHNs, to their homes. Thus, we revised the C-HOME scale to serve as a tool to inform evaluation when direct observation is not possible. Further, we shortened the tool so that when health care professionals are able to access the home environment, the assessment can be conducted efficiently. The HEAS can also provide helpful guidance for immigrant families or vulnerable families in self-assessing their home environment. However, we recommend that future studies focus on infant, toddler, and/or preschool aged children, especially since the early home environment impacts child development on multiple levels (Rijlaarsdam et al., 2012).

Limitation

A limitation of this study is that the revised HEAS was tested on caregivers of elementary school children in the families of immigrants primarily from mainland China and Southeast Asian countries (Vietnam and Indonesia). Therefore, the utility of the revised HEAS for broader immigrant populations that do not meet these criteria may not be generalized. Nevertheless, the study results affirm HEAS's validity and practicality as a culturally appropriate instrument for assessing the home environment of transnational families in Taiwan. HEAS's psychometric properties are suited to clinical and research applications. In utilizing

HEAS, pediatric health care professionals can better respond to these families' specific cultural needs and expectations and thus provide the most appropriate care in support of the well-being of elementary school-aged children and their immigrant mothers. Accurately assessing the home environment of transnational families may be useful not only in helping these vulnerable families to support their children's well-being but also to inform broader familial interventions and proactive initiatives in support of a nurturing home environment. Because of the cultural specificity of some HEAS items, additional research is suggested related to the scale's applicability and possible need for modification for use outside Taiwan and Taiwanese communities.

Practice implications

The HEAS-27 is an effective instrument that addresses the needs and support from home environment, including "daily routine" (DR), "active stimulation for growth" (ASG), "positive emotional treatment" (PET), "environmental diversity" (ED), "participation in school activities" (PSA), "parenting involvement" (PI), and "interpersonal and communication stimuli" (ICS). The HEAS-27 are easy to manipulate because of their "either/or" nature, with "yes" reflecting desired family input and resulting in a credit and "no" resulting in no credit. Therefore, the items can guide pediatric health care professionals in promptly screening, evaluating, and teaching families in short time. If the families were not easy to approach, the HEAS-27 can be used for transnational families to evaluate by themselves regarding home environment support for elementary school children if they are not easy to approach. Furthermore, it is useful for health promotion programs need to increase public awareness of all transnational family home risk factors for children. Items can provide guidance for pediatric nurses and public health nurses to take the appropriate preventative actions for the general population.

Conclusion

In this study, we aimed to provide a convenient and efficient screening tool that makes it easy for pediatric health care professionals to evaluate and immediately intervene as necessary to make home environment support available for children in transnational families or vulnerable families. The HEAS-27 was developed to be a guide for promptly screening, evaluating, and teaching families so that children in a vulnerable population have adequate quality and quantity of support in the home environment. Its reliability and validity are statistically indicated, and its internal consistency is supported through item analysis, with K-R 20 statistics both above 0.6, a level commonly acknowledged as a standard in evaluating such scales (Gerber & Finn, 2013; Knapp, Raynor, Thistlethwaite, & Jones, 2009). Further, the test-retest revealed a significant correlation between participants' scores at Time 1 and Time 2, which shows the scale's consistency. Finally, HEAS reflects current knowledge on children's home environments and development while utilizing culturally appropriate wording.

The data from the 200 participants who responded to all items suggests the applicability of the new HEAS-27 across healthcare-related settings, including research, community education for vulnerable families, and practice for pediatric health care professionals.

Protection of human subjects

We obtained ethical approval (99-3184B) from the Institutional Review Board (IRB) of Chang Gung Medical Foundation. We conducted the study in accordance with the 1964 Helsinki Declaration on research involving human subjects. Informed consent was obtained from all individual participants included in the study.

Declaration of competing interest

The authors declare that they have no competing interests.

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Author statement

Hwey-Fang Liang (HF) and Kuang-Ming Wu (KM) contributed to conception and design. HF, KM, and Cheng-Hsing Weng (CH) contributed to data collection. HF, and Yong-Chuan Chen (YC) contributed to data analysis. All authors contributed toward drafting and critically revising the paper and agreed to be accountable for all aspects of the work.

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